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Lists of Species

Checklist of amphibians in a transitional area between the Caatinga and the Atlantic Forest, central-southern Bahia, Brazil

Amanda S. F. Lantyer Silva [1*], Sérgio Siqueira Júnior [2] and Juliana Zina [2]

1 Universidade Estadual de Santa Cruz (UESC), Programa de Pós-Graduação em Ecologia e Conservação da Biodiversidade, Rodovia Ilhéus-Itabuna, km 16. CEP 45662-000. Ilhéus, BA, Brazil.
2 Universidade Estadual do Sudoeste da Bahia (UESB), Departamento de Ciências Biológicas, Rua José Moreira Sobrinho, Jequiezinho. CEP 45206-190. Jequié, BA, Brazil.
* Corresponding author. E-mail: *asbiologa@gmail.com*

Abstract: We present a list of amphibian species from Serra do Brejo Novo, municipality of Jequié, state of Bahia in Brazil, a transition zone between the Caatinga and the Atlantic Forest that encompasses a great diversity of species and reproductive modes. Between November 2009 and April 2010 we surveyed the area using pitfall traps and between August 2010 and February 2012 data was collected using active search methodology. We recorded 32 species belonging to seven families. The unexpected composition of species and reproductive modes of this community highlight the importance of species inventories and also the need for exploring transitional areas to understand the ecological mechanisms responsible for changes in community structures between different zones.

Introduction

Bahia is a Brazilian state with a mosaic of vegetation formations, including areas of Cerrado, Caatinga and Atlantic Forest, as well as extensive zones of transitional vegetation between these biomes (SEMA 2007). The fauna of these domains and transition areas is still insufficiently sampled and anthropogenic changes that modify the structure of the landscape are a threat to the local taxa, especially those which have been poorly studied or are as yet unknown. The scarcity of studies in transitional environments is probably related to the fact that few transitional areas are protected and most of them have been and still are subject to impacts caused by human activities (Sabbag and Zina 2011).

Anurans are among the less studied vertebrate groups in the state. Although, recently, there has been an increase of studies in the region, such as several species inventories (Rodrigues 2003, Silvano and Pimenta 2003; Juncá 2006; Valdujo *et al.* 2009; Camurugi *et al.* 2010) and studies of population reproductive biology (Vilaça *et al.* 2011; Dias *et al.* 2011), the continuous increase in records extending known geographic distributions (Napoli *et al.* 2010; Dias *et al.* 2010), as well as the increase in the number of new species described from the state (Lugli and Haddad 2006a; 2006b; Cassimiro *et al.* 2008; Cruz *et al.* 2008; Pimenta *et al.*, 2009; Napoli *et al.* 2011; Lourenço-de-Moraes *et al.* 2012), indicates that there are still areas, ecological aspects, species and communities that have yet to be explored in Bahia.

Only after increasing the knowledge about the anurans of the state it will be possible to establish a comprehensive list of species of Bahia, as has been done for the state of São Paulo (see Araújo *et al.* 2009), and at the same time identify the ecological patterns present and in need of being recognized for the establishment of conservation targets for the group.

Although of fundamental importance, species inventories, when they are not accompanied by biological information, such as reproduction, add little to our knowledge about the influence of abiotic factors, climate and vegetation on the life cycle of species and on modulating the composition and diversity of species existing in a given area. Still fewer is the number of studies that emphasize the importance of reproduction as a biological factor that can modulate communities in semi-arid environments such as the Caatinga (*e.g.* Arzabe 1999, Vieira *et al.* 2007, Vieira *et al.* 2009).

Thus, the aims of this study were: (1) register amphibian species in an area of Atlantic Forest-Caatinga ecotone located in central-southern Bahia, (2) identify the reproductive modes presented by the species, (3) establish the reproductive seasonal pattern of the species, and (4) verify if reproductive aspects of the species may explain their spatial distribution in the study area.

Material and Methods

Study area

This study was conducted in a forest fragment within the 74ha deciduous mountain forest (Macedo 2007), located in the Serra do Brejo Novo farm (13°56’41” S and 40°06’33.9” W; 617-755m asl), 12 km from the town of Jequié, state of Bahia, Brazil (Figure 1). The area is characterized as a transitional zone with rugged and mountainous environments and vegetation typical of the semi-deciduous Atlantic Rain Forest, surrounded by Caatinga xerophytic vegetation, with lakes and ponds in its lower section. Human activities such as logging, ranching and hunting take place in the fragment and its vicinities.

Data collection

Data collection using pitfall traps was carried out monthly, for seven consecutive days, from November 2009 to April 2010. Three sets of pitfall traps with drift fences (Cechin and Martins 2000; Calleffo 2002) were installed along the main 256m track in the forest interior. The traps were placed in a "Y" shape with four 60L buckets at each end and connected by five meters of 50cm high plastic sheeting. The first set of buckets was set at 131m from the beginning of the main track and each consecutive set was placed 60m away from the previous one along the main track, 25m from the track.

Additional data were collected by active search methodology at the reproductive site (Heyer *et. al.* 1994) from August 2010 to February 2012, when fieldwork was carried out during the night weekly in the rainy season (October-March) and monthly in the dry season (April-September). Four types of environments were sampled over this period of time: (1) permanent lake: 10m in diameter and maximum depth of 1m, surrounded by cattails and grass; (2) temporary water bodies: (a) temporary pond in an open disturbed area, maximum length of 7m and maximum depth of 40cm surrounded by grasses and (b) temporary stream, maximum width of 1.20m and maximum depth of 40cm, also surrounded by grasses; (3) semi-permanent lake with a maximum length of 3m and maximum depth of 50cm, characterized by the presence of shrubs and grasses; and (4) fragment interior, where an area of 1.3ha was sampled by searches in the leaf litter, under fallen tree trunks, in burrows and in bromeliads. Data collection started just before sunset and ended around 24:00h.

Type specimens were collected, sacrificed with 5% xylocaine, fixed in 10% formaldehyde and preserved in 70% ethanol. All species were collected under the permit of the Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (IBAMA / ICMBio - 20328-1) and the voucher specimens are deposited in the Coleção de Zoologia of the Universidade Estadual do Sudoeste da Bahia (Museu de História Natural de Jequié Coleção Herpetológica - MHNJCH).

Results and Discussion

A total of 32 amphibian species, divided into two orders (Anura and Gymnophiona) and seven families, was recorded (Table 1) (Figures 2 and 3). Most species

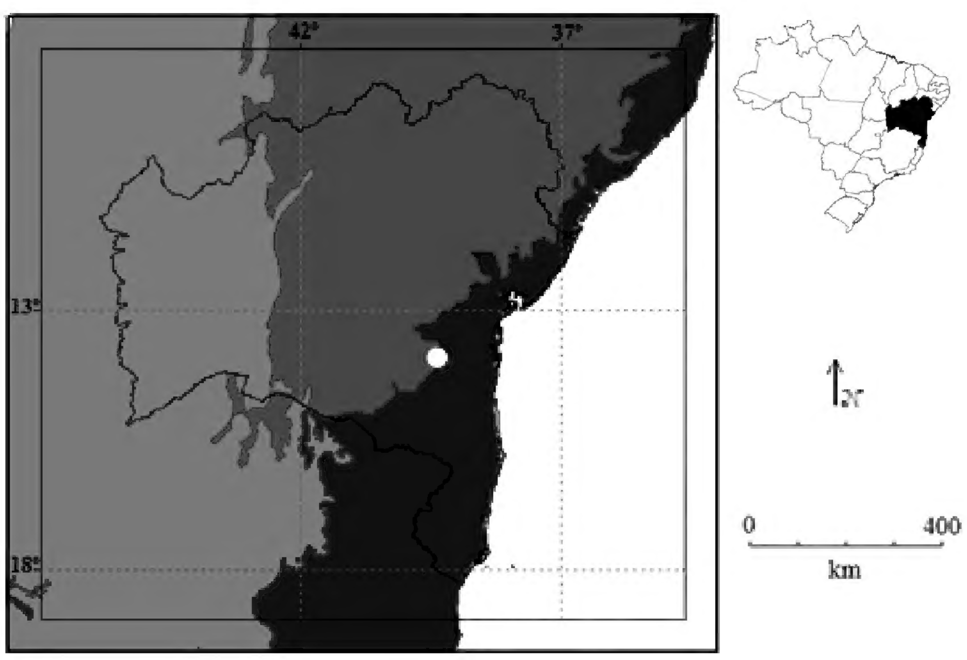

Figure 1. Geographic location of the study site (white circle), the Serra do Brejo Novo farm, municipality of Jequié, state of Bahia, Brazil.

(N = 17) belong to the family Hylidae, and this family also showed the largest number of reproductive modes (N = 4). Hylids are commonly predominant in studies of anuran communities in Neotropical regions (see Prado *et al.* 2005; Brasileiro *et al.* 2005; Zina *et al.* 2007) due to the diversity of species in the family and their arboreal habits, which allow them to explore various types of plants as breeding substrates (Zina *et al.* 2012). We observed the reproductive mode of approximately 52% of the all registered species, for the other species we consider the data available in the literature (Table 1).

The survey methods used in the present study to register the amphibian species richness (active search and pitfall traps) turned out to be complementary. However, active search was the most efficient method; only five species were registered using pitfall traps, being two of them (*Chiasmocleis schubarti* and *Siphonops annulatus*) collected exclusively by this method. Nevertheless, we need to consider the time during which both methods were performed (pitfall traps, 6 months; active search, one year and 6 months) that could interfere in the capture efficiency of them, as wells as the limitations imposed by the methods to detect explosive breeders (active search) and arboricolous frogs (pitfall traps) (Cechin and Martins 2000).

The richness of species found in the Serra do Brejo Novo farm (N = 32) can be considered intermediate when compared to other localities of the Atlantic Forest, in which richness varies between 16 and 65 species (Heyer *et al.* 1990; Bertoluci and Rodrigues 2002; Silvano and Pimenta 2003; Prado *et al.* 2009). At the same time, the richness registered in the present study can be considered relatively high when compared to areas of Caatinga that have already been studied and that richness varied between 9 and 19 species (Arzabe 1999; Loebmann and Haddad 2010). Studies of Atlantic Forest- Caatinga ecotone in two other states (Sergipe - Carvalho, Villar and Oliveira 2005; Rio Grande do Norte - Magalhães *et al.* 2013) and at another locality in Bahia (Serra da Jibóia - Juncá 2006) reveals an amplitude of richness smaller than to the biomes separately; the species richness is ranging from 29 to 34 species and reinforce the pattern that transitional areas tend to present high richness.

There are four possibilities to explain the values of species richness in the region and that can possibly elucidate the richness in other ecotone zones in the same situation: (1) the area suffers from the effects of human disturbance and this has a negative effect on species richness when compared to areas under great influence of the Atlantic Forest; (2) human disturbance has a positive effect on richness, since it favors colonization by tolerant and widely distributed species (Moraes *et al.* 2007) and, therefore, the number of species in the area is greater than would be expected in areas of Caatinga; (3) the area is typically transitional and, therefore, the diversity of microenvironments exceeds those available in other areas of Caatinga; and (4) a synergy of the above factors. Although we cannot exclude completely any of the above hypotheses, the presence of five species that belong to Atlantic forest domains and five others typically found in Caatinga, may corroborate the third hypothesis (Table 1).

Of the species for which the geographical distribution

is available in the literature, 33.3% are restricted to areas of Atlantic Forest or Caatinga (Table 1). The distribution of the species *Scinax* cf. *auratus* and *Leptodactylus latrans* has not been evaluated due to lack of more precise identification of the former and a recent taxonomic revision of the group to which the latter belongs (Lavilla *et al.* 2010).

By analyzing the geographical distribution, reproductive modes, and use of the environment for breeding activity, the only observable patterns in the community under study are that (1) for both widely distributed species and species of more restricted distribution, reproductive mode 1 (eggs and exotrophic tadpoles in lentic water) was the most common, as observed in other studies of Neotropical communities (Zimmerman and Simberloff 1996; Zina *et al.* 2007; Camurugi *et al.* 2010); (2) reproductive modes involving foam nests were typically observed in species that occupied temporary environments, as also observed for other anuran communities (Vieira *et al.* 2007; Kopp *et al.* 2010); and (3) the only species with direct development (*Haddadus binotatus*) was recorded in breeding activity only in the interior of the fragment, which also corroborates the data available in the literature (Canedo and Rickli 2006; Camurugi *et al.* 2010; Sabbag and Zina 2011). Thus, apparently, the reproductive modes did not determine the range of the geographic distributions but is strongly related to the occupation of a particular type of breeding site and may determine the spatial distribution of the species, as in the two cases mentioned above.

The spatial distribution of species in the visited water bodies, as well as their breeding pattern, can be summarized as follows:

1. Permanent pond (PP): 11 species were recorded in reproductive activity in this environment, and most of them had prolonged or continuous breeding patterns (Table 1). The use of the environment varied from cattail leaves (*Dendropsophus* spp., *Scinax* cf. *auratus*, and *Scinax pachycrus*), grasses (*Dendropsophus* spp.), soil near or in the water (*Hypsiboas crepitans*, *Leptodactylus vastus, Physalaemus kroyeri, Rhinella granulosa, R. jimi*, and *Scinax x-signatus*), and shrubs near the permanent pond (*Hypsiboas crepitans, H. faber*, and *Phyllomedusa bahiana*).

2. Temporary ponds in an open environment (TP): 21 species were recorded, most of which showed an explosive breeding pattern (Table 1). In this environment the species were observed using grasses (*Dendropsophus* spp., *Phyllomedusa nordestina*, *Sphaenorhynchus prasinus*), and soil near or in the water (*Dermatonotus muelleri, Leptodactylus* spp., *Physalaemus* spp.) as calling sites.

3. Forest fragment (FF): four species of anurans and one of Gymnophiona were recorded in this habitat (Table 1), however, no species was observed in reproductive activity in the forest interior except for an individual of *Hadaddus binotatus* calling from a leaf approximately 1.5 m high.

Considering that reproductive mode is the set of features that include oviposition sites, ovum and clutch characteristics, rate and duration of larval development and parental care, if any (Salthe and Duellman 1973), it would not be surprising if the temporal and spatial distribution of species were somehow related to reproductive modes. Most species that uses temporary water bodies as oviposition site are expected to exhibit explosive breeding behavior. In this study, of the 28 species with observed reproductive mode and breeding patterns, 46.4% used temporary ponds as breeding sites and also had explosive breeding patterns (Table 1). Temporary environments are more likely to dry up and are, therefore, occupied by species with rapid development and those that build foam nests allowing the larvae to survive until the next rain (Zina 2006). Furthermore, near 64% of the recorded species showed an explosive breeding pattern, a fact that may be related to seasonal features of the study area.

Therefore, the reproductive mode and the spatial and temporal distribution of anuran species are co-dependent factors and cannot be considered in isolation. Moreover, the correlation between these processes should be viewed from a local perspective, considering the characteristics of the studied environments, and not from such broad perspectives as morphoclimatic classification or geographic location.

The Serra do Brejo Novo farm harbors a set of heterogeneous habitats, which provide a high variety of spatial and climatic features, also reflecting the heterogeneous composition of the species. These amphibian populations are under increasing pressure of fragmentation in an area of transition between two vegetation domains, the Atlantic Rain Forest and the Caatinga. The continuity of studies with this amphibian community is important for understanding the dynamics of these populations. The richness of species in the area and the diversity of reproductive modes highlight the importance of the transition areas being investigated. Moreover, additional comparative studies should be performed in different domains to understand if the anuran diversity results from different vegetation/climatic types that permit the occurrence of species with different reproductive modes.

Moreover, the Caatinga and its transitional regions make up a unique environment in Brazil with high endemism and climate peculiarities, but they are still poorly studied (*e.g.* Tabarelli and Vincente 2004). Inappropriate land use has caused environmental damage and acceleration of desertification (Leal *et al.* 2005) which makes this region a priority for biological studies (Camardelli and Napoli 2012).

Importance of inventories

Recently, studies of species inventories have received little attention from the scientific community, and the more specialized journals no longer publish this type of data. However, it is known that in order to determine ecological patterns of species occurrence or to determine anthropogenic effects on fauna and flora, data on the composition of communities are needed. Publication of species lists should be encouraged, in order to bring together information about temporal, spatial and reproductive aspects since they contribute to our understanding about the natural history of these species and provide insights into population differences that help in systematics, taxonomy and conservation.

Table 1. List of amphibian species sampled from Serra do Brejo Novo farm with reproductive aspects, collecting method, spatial distribution and voucher specimens. The reproductive modes (Reprod. Mode) follow the classification proposed by Haddad and Prado (2005). Reproductive patterns: E= explosive (*sensu* Wells, 2007), P = prolonged (*sensu* Wells, 2007), C= continuous (*sensu* Crump, 1974), NO = Not observed; Collecting method: ACS= Active Search, PIT = Pitfall traps, * Collected in the vicinities; ** = pers. comm. (Victor Dill); Spatial distribution: TP = temporary pond, PP = permanent pond, FF= forest fragment; Geographic distribution: WIDE = more than one domain, CA = Caatinga, AF = Atlantic Forest; OB = reproductive modes observed in the field.

TAXON	REPROD. MODE	REFERENCE	REPROD. PATTERN	SAMPLING METHOD	SPATIAL DISTRIBUTION	GEOGRAPHIC DISTRIBUTION	REFERENCE	VOUCHER
ANURA								
BUFONIDAE								
Rhinella jimi (Stevaux, 2002)	**1**	OB	**P**	ACS	PP	WIDE	Loebmann and Haddad 2010	MHNJCH 242
Rhinella granulosa (Spix, 1824)	**1**	OB	**E**	ACS	PP/TP	WIDE	Narvaes and Rodrigues 2009	MHNJCH 066
CRAUGASTORIDAE								
Haddadus binotatus (Spix, 1824)	**23**	Haddad and Prado 2005	**E**	PIT/ACS	FF	WIDE	IUCN 2012	MHNJCH 073
ODONTOPHRYNIDAE								
Odontophrynus carvalhoi Savage and Cei, 1965	**1**	OB	**E**	PIT/ACS	TP/IF	WIDE	Lisboa *et al.* 2010	MHNJCH 120
HYLIDAE								
Dendropsophus bipunctatus (Spix, 1824)	**1**	Haddad, Toledo and Prado 2008	**E**	ACS	TP	AF	IUCN 2012	MHNJCH 449
Dendropsophus branneri (Cochran, 1948)	**1**	OB	**P**	ACS	TP/PP	WIDE	IUCN 2012	MHNJCH 127
Dendropsophus elegans (Wied-Neuwied, 1824)	**1**	OB	**P**	ACS	TP	WIDE	IUCN 2012	MHNJCH 446
Dendropsophus minutus (Peters, 1872)	**1**	Haddad and Prado 2005	**P**	ACS	TP	WIDE	IUCN 2012	MHNJCH 450
Dendropsophus novaisi (Bokermann, 1968)	**-**	-	**E**	ACS	TP	WIDE	Santos-Silva *et al.* 2012	MHNJCH 322
Dendropsophus oliveirai (Bokermann, 1963)	**24**	**	**NO**	ACS*	TP	CA	IUCN 2012	MHNJCH 402
Hypsiboas crepitans (Wied-Neuwied, 1824)	**1**	OB	**C**	ACS	PP	WIDE	IUCN 2012	MHNJCH 029
Hypsiboas faber (Wied-Neuwied, 1821)	**4**	OB	**E**	ACS	PP	WIDE	IUCN 2012	Not Collected
Phyllomedusa bahiana Lutz, 1925	**24**	Haddad and Prado 2005	**P**	ACS	PP	AF	IUCN 2012	MHNJCH 082
Phyllomedusa nordestina Caramaschi, 2006	**24**	Haddad and Prado 2005	**E**	ACS	TP	CA	IUCN 2012	MHNJCH 121
Scinax camposseabrai (Bokermann, 1968)	**1**	OB	**E**	ACS	TP	WIDE	Cândido *et al.* 2012	MHNJCH 326
Scinax eurydice (Bokermann, 1968)	**1**	Arzabe *et al.* 1998	**NO**	ACS	TP	AF	IUCN 2012	MHNJCH 426
Scinax cf. *auratus* (Wied-Neuwied, 1821)	**1**	OB	**P**	ACS	PP	-	IUCN 2012	MHNJCH 247
Scinax pachycrus (Miranda-Ribeiro, 1937)	**1**	OB	**E**	ACS	PP	CA	IUCN 2012	MHNJCH 173
Scinax x-signatus (Spix, 1824)	**1**	OB	**E**	ACS	PP	WIDE	IUCN 2012	MHNJCH 136
Sphaenorhynchus prasinus Bokermann, 1973*	**1**	Haddad, Toleto and Prado 2008	**E**	ACS	TP	AF	dos-Santos and Moura 2009	MHNJCH 182
Trachycephalus atlas Bokermann, 1966	**1**	OB	**E**	ACS	TP	WIDE	Roberto *et al.* 2011	MHNJCH 314
LEPTODACTYLIDAE								
Physalaemus kroyeri (Reinhardt and Lütken, 1862)	**11**	OB	**P**	ACS/PIT	PP/TP	WIDE	IUCN 2012	MHNJCH 069
Physalaemus cicada Bokermann, 1966	**11**	OB	**E**	ACS	TP	CA	Linares and Mello 2011	MHNJCH 098
Pleurodema diplolister (Peters, 1870)	**11**	OB	**E**	ACS	TP	CA	Andrade and Vaz-Silva 2012	MHNJCH 101
Leptodactylus fuscus (Schneider, 1799)	**30**	Haddad and Prado 2005	**P**	ACS	TP	WIDE	IUCN 2012	MHNJCH 118
Leptodactylus mystacinus (Burmeister, 1961)	**30**	Haddad and Prado 2005	**E**	ACS	TP	WIDE	IUCN 2012	MHNJCH 105
Leptodactylus troglodytes Lutz, 1926	**30**	Arzabe *et al.* 1998	**P**	ACS	TP	WIDE	Loebmann and Haddad 2010	MHNJCH 106
Leptodactylus vastus Lutz, 1930	**13**	Arzabe *et al.* 1998	**E**	ACS	PP	WIDE	Loebmann and Haddad 2010	MHNJCH 086
Leptodactylus latrans (Steffen, 1815)	**11**	Haddad and Prado 2005	**E**	ACS	TP	-	IUCN 2012	MHNJCH 035
MICROHYLIDAE								
Dermatonotus muelleri (Boettger, 1825)	**1**	OB	**E**	ACS	TP	WIDE	IUCN 2012	MHNJCH 313
Chiasmocleis schubarti Bokermann, 1952	**1**	Haddad, Toledo and Prado 2008	**NO**	PIT	FF	AF	Pimenta and Silvano 2002	MHNJCH 424
GYMNOPHIONA								
SIPHONOPIDAE								
Siphonops annulatus (Mikan, 1820)	-	-	-	PIT	FF	WIDE	IUCN 2012	MHNJCH 414

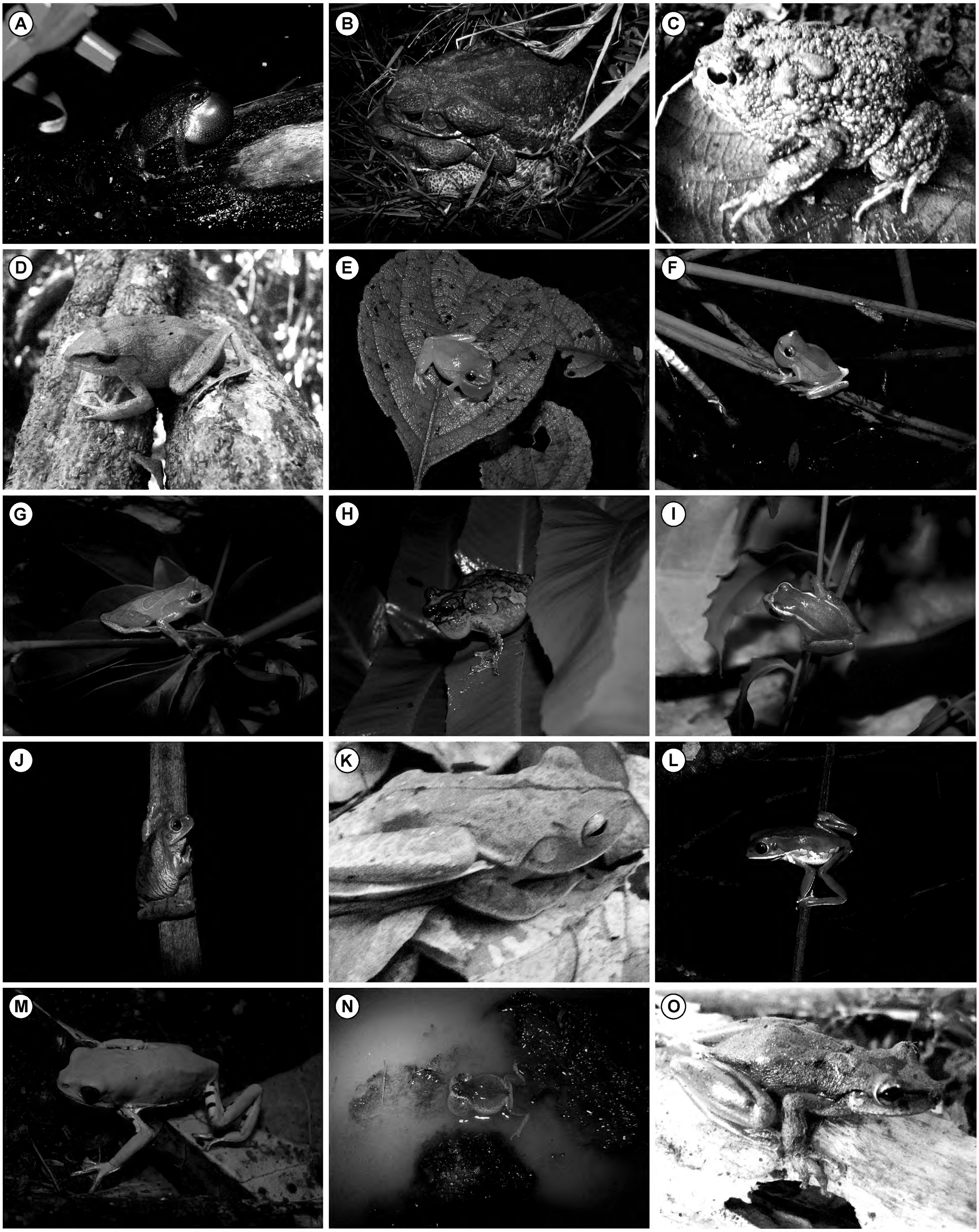

Figure 2. Amphibians found at the Serra do Brejo Novo farm, municipality of Jequié, state of Bahia, from November 2009 to April 2010. Family Bufonidae: A- *Rhinella granulosa*, B- *Rhinella jimi*; Family Odontophrynidae: C- *Odontophrynus carvalhoi*; Family Craugastoridae: D- *Haddadus binotatus*; Family Hylidae: E- *Dendropsophus bipunctatus*, F- *Dendropsophus elegans*, G- *Dendropsophus minutus*, H- *Dendropsophus novaisi*, I- *Dendropsophus oliveirai*, J- *Hypsiboas crepitans*, K- *Hypsiboas faber*, L- *Phyllomedusa bahiana*, M- *Phyllomedusa nordestina*, N- *Scinax camposseabrai*, O- *Scinax eurydice*,

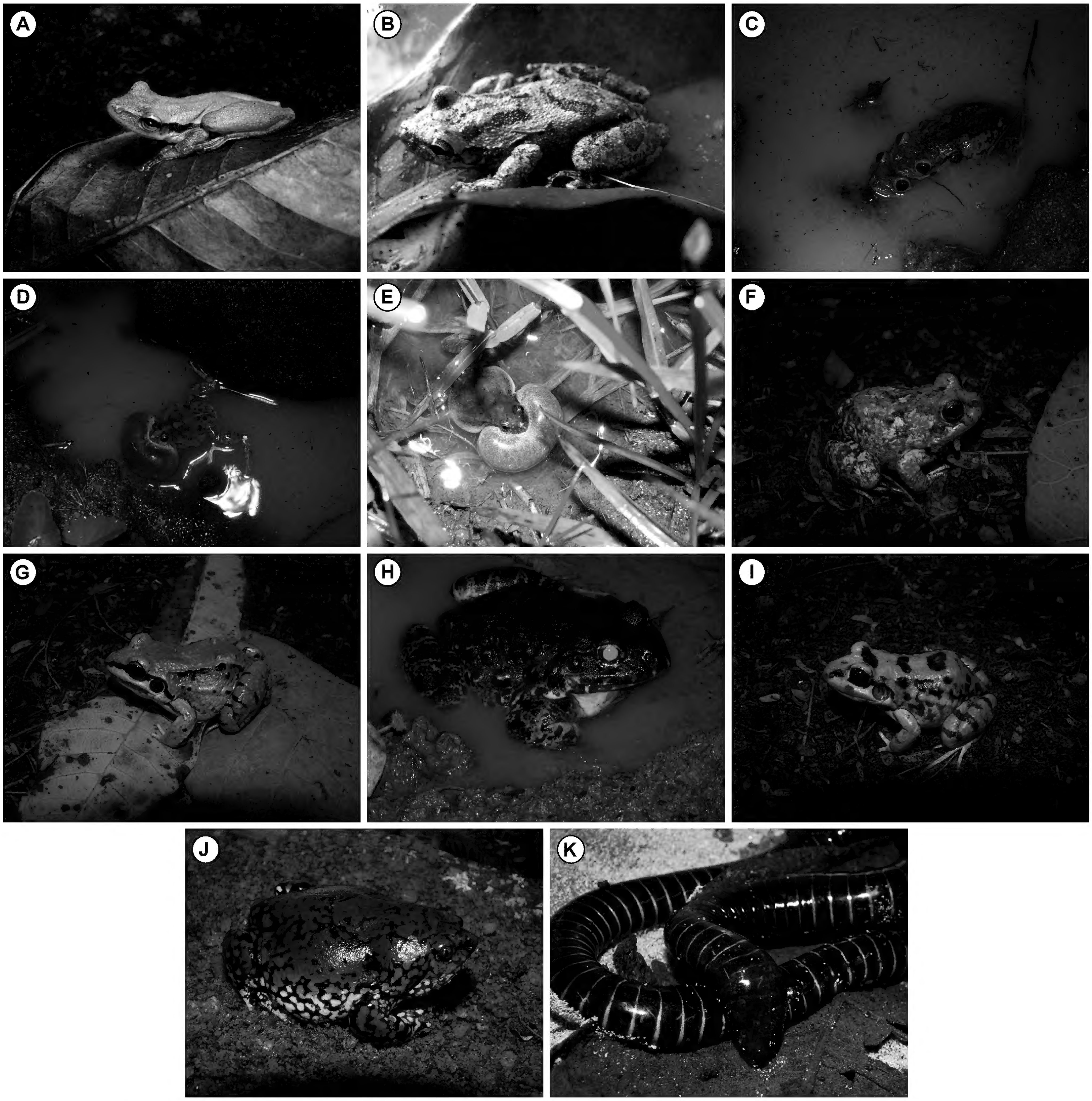

Figure 1. Amphibians found at the Serra do Brejo Novo farm, municipality of Jequié, state of Bahia, from November 2009 to April 2010. Family Hylidae: A- *Scinax pachycrus*, B- *Scinax x-signatus*, C- *Trachycephalus atlas*, Family Leptodactylidae: D- *Physalaemus cicada,* E- *Physalaemus kroyeri*, F- *Pleurodema diplolister*; G- *Leptodactylus mystacinus*, H- *Leptodactylus vastus,* I- *Leptodactylus troglodytes*; Family Microhylidae: J- *Dermatonotus muelleri*; Family Siphonopidae: K, *Siphonops annulatus.*

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Literature Cited

Andrade, S.P. and W. Vaz-Silva. 2012. First state record and distribution extension of *Pleurodema diplolister* (Peters 1870) (Anura: Leiuperidae) from state of Goiás, Brazil. *Check List* 8(1):149-151.

Araújo, O.G.S., L.F. Toledo, P.C.A. Garcia and C.F.B. Haddad. 2009. The amphibians of São Paulo State. *Biota Neotropica* 9(4): 197-209.

Arzabe, C. 1999. Reproductive activity patterns of anurans in two different altitudinal sites within the Brazilian Caatinga. *Revista brasileira de Zoologia* 16 (3): 851-864.

Arzabe, C., C.X. Carvalho, M.A.G. Costa. 1998. Anuran assemblages in Crasto forest ponds (Sergipe State, Brazil): comparative structure and calling activity patterns. *Herpetological Journal* 8: 111–113.

Bertoluci, J. and M.T. Rodrigues. 2002. Utilização de habitats reprodutivos e microhabitats de vocalização em uma taxocenose de anuros (Amphibia) na Mata Atlântica no Sudeste do Brasil. *Papéis Avulsos de Zoologia* 42: 287-297.

Brasileiro, C.A., R.J. Sawaya, M.C. Kiefer, and M. Martins. 2005. Amphibians of an open Cerrado fragment in southeastern Brazil. *Biota Neotropica* 5(2): 1-16.

Calleffo, M.E.V. 2002. Anfíbios; p. 45-73 *In* P. Auricchio and M. G. Salomão (ed.). *Técnicas de Coleta e Preparação de Vertebrados para Fins Científicos e Didáticos*. São Paulo: Instituto Pau Brasil de História Natural.

Camardelli, M. and M.F. Napoli. 2012. Amphibian Conservation in the Caatinga Biome and Semiarid Region of Brazil. *Herpetologica* 68(1): 31-47.

Camurugi, F., T.M. Lima, E.A. Mercês and F.A. Juncá. 2010. Anurans of the Reserva Ecológica da Michelin, Municipality of Igrapiúna, State of Bahia, Brazil. *Biota Neotropica* 10(2): 305-312.

Cândido, C.E.R., R.A. Brandão, M.A. Freitas, W.A. Coelho, E.L. Felberg. 2012. Amphibia, Anura, Hylidae, *Scinax camposseabrai* (Bokermann, 1968): Geographic distribution and map. *Check List* 8(2): 272-273.

Canedo, C. and E. Rickli. 2006. Female Reproductive Aspects and Seasonality in the Reproduction of *Eleutherodactylus binotatus (*Spix, 1824) (Amphibia, Leptodactylidae) in an Atlantic Rainforest fragment, Southeastern Brazil. *Herpetological Review* 37(2): 149-151.

Carvalho, C.M., J.C. Villar and F. F. Oliveira. 2005. Répteis e anfíbios; p. 39-61 *In* Carvalho, C.M., Villar, J.C. (ed.) *Parque Nacional Serra de Itabaiana: Levantamento da Biota*. Aracaju: IBAMA.

Cassimiro, J., V.K. Verdade and M.T. Rodrigues. 2008. A large and enigmatic new eleutherodactyline frog (Anura, Strabomantidae) from Serra do Sincorá, Espinhaço range, northeastern Brazil. *Zootaxa* 1761: 59-68.

Cechin, S.Z. and M. Martins. 2000. Eficiência de armadilhas de queda (pitfall traps) em amostragens de anfíbios e répteis no Brasil. *Revista Brasileira de Zoologia* 17(13): 729-740.

Crump, M. L. 1974. Reproductive strategies in a tropical anuran community. *Misc. Publ. Mus. Nat. Hist. Univ. Kansas*, 61: 1-68.

Cruz, C.A.G., M.F. Napoli and P.M. Fonseca. 2008. A new species of *Phasmahyla* Cruz, 1990 (Anura: Hylidae) from the State of Bahia, Brazil. *South American Journal of Herpetology* 3(3): 187-195.

Dias, I.R., D. Rödder, F. Weinsheimer, A. Kwet and M. Solé. 2011. Description of the advertisement call of *Phasmahyla spectabilis* Cruz, Feio & Nascimento, 2008 (Anura: Phyllomedusinae) with comments on its distribution and reproduction. *Zootaxa* 2767: 59-64.

Dias, I.R., T.R.A. Vilaça, J.R.S. Silva, R.S. Barbosa and M. Solé. 2010. Amphibia, Anura, Hylidae, *Trachycephalus nigromaculatus* Tschudi, 1838: Distribution extension. *Check List* 6(3): 412-413.

Dos-Santos, E.M. and G. J. B. Moura. 2009. Geographic Distribution: *Sphaenorhynchus prasinus*. *Herpetological Review* 40 (3): 362-363.

Haddad, C.F.B., and C.P.A. Prado. 2005. Reproductive Modes in Frogs and Their Unexpected Diversity in the Atlantic Forest of Brazil. *BioScience* 55 (3): 207.

Haddad, C.F.B., L.F. Toledo and C.P.A. Prado. 2008. *Anfíbios da Mata Atlântica: guia dos anfíbios anuros da Mata Atlântica*. São Paulo: Editora Neotropica. 243p.

Heyer, W.R., M.A. Donnelly, R.W. McDiarmid, L.C. Hayek and M. Foster. 1994. *Measuring and monitoring biological diversity: standard methods for amphibians*. Washington and London: Smithsonian Institution Press. 364p.

Heyer, W.R., A.S. Rand, C.A.G da Cruz, O.L. Peixoto and C.E. Nelson. 1990. Frogs of Boracéia. *Arquivos de Zoologia* 34: 231-410.

IUCN. 2012. *IUCN Red List of Threatened Species. Version 2012.1.* Electronic Database. Accessible at http://www.iucnredlist.org/. Captured on 12 July 2012.

Juncá, F.A. 2006. Diversidade e uso de hábitat por anfíbios anuros em duas localidades de Mata Atlântica, no norte do estado da Bahia. *Biota Neotropica* 6(2): 1-16.

Kopp, K.K., L. Signorelli and R.P. Bastos. 2010. Distribuição temporal e diversidade de modos reprodutivos de anfíbios anuros no Parque Nacional das Emas e entorno, estado de Goiás, Brasil. *Iheringia*, Sér. Zool. 100(3): 192-200.

Lavilla, E.O., J. A. Langone, U. Caramaschi, W.R. Heyer and R.O. de Sá. 2010. The identification of *Rana ocellata* Linnaeus, 1758. Nomenclatural impact on the species currently known as *Leptodactylus ocellatus* (Leptodactylidae) and *Osteopilus brunneus* (Gosse, 1851) (Hylidae). *Zootaxa* 2346:1-16.

Leal, I.R., J.M.C. da Silva, M. Tabarelli and T.E. Lancher Jr. 2005. Changing the Course of Biodiversity Conservation in the Caatinga of Northeastern Brazil. *Conservation Biology* 19(3):701-706.

Linares, A.M. and H.E.S. Mello. 2011. *Physalaemus cicada* Bokermann, 1966 (Anura: Leiuperidae): Distribution extension with new south limit and geographic distribution map. *Check List* 7(6):859-861.

Lisboa, B.S., U.G. Silva and C.F.B. Haddad. 2010. Amphibia, Anura, Cycloramphidae, *Odontophrynus carvalhoi* Savage and Cei, 1965: Distribution extension and geographical distribution map. *Check List* 6(4):493-494.

Loebmann, D. and C.F.B. Haddad. 2010. Amphibians and reptiles from a highly diverse area of the Caatinga domain: composition and conservation implications. *Biota Neotropica* 10(3): 227-256.

Lourenço-de-Moraes, R., M. Solé and L.F.Toledo. 2012. A new species of *Adelophryne* Hoogmoed and Lescure 1984 (Amphibia: Anura: Eleutherodactylidae) from the Atlantic rainforest of southern Bahia, Brazil. *Zootaxa* 3441: 59–68.

Lugli, L. and C.F.B. Haddad. 2006a. A new species of the *Bokermannohyla pseudopseudis* group from central Bahia, Brazil (Amphibia, Hylidae). *Herpetologica* 62: 453-465.

Lugli, L. and C.F.B. Haddad. 2006b. New species of *Bokermannohyla* (Anura, Hylidae) from central Bahia, Brazil. *Journal of Herpetology* 40: 7-15.

Macedo, G.E.L. 2007. *Composição florística e Estrutura do Componente Arbóreo-Lianescente de um Trecho de Floresta Estacional Semidecidual no Município de Jequié, Bahia, Brasil*. Unpublished Ph.D. Thesis, Programa de Pós-Graduação em Botânica. Recife: Universidade Federal Rural de Pernambuco. 102 p.

Magalhães, F.de M., A.K.B. da P. Dantas, M.R.M. de Brito, P.H.S. de Medeiros, A.F. Oliveira, T.C.S. de O. Pereira, M.H.C. de Queiroz, D.J. Santana, W.P. da Silva and A.A. Garda. 2013. Anurans from an Atlantic Forest-Caatinga ecotone in Rio Grande do Norte State, Brazil. Herpetology Notes 6: 1-10.

Magnusson, W.E. and J.M. Hero. 1991. Predation and the evolution of complex oviposition behaviour in Amazon rainforest frogs. *Oecologia* 86: 310-318.

Moraes, R.A. de, R.J. Sawaya and W. Barrela. 2007. Composição e diversidade de anfíbios anuros em dois ambientes de Mata Atlântica no Parque Estadual Carlos Botelho, São Paulo, sudeste do Brasil. *Biota Neotropica* 7(2): 27-36.

Napoli, M.F., F.A. Juncá, D. Cruz and R.O. Abreu. 2010. Amphibia, Anura, Strabomantidae, *Strabomantis aramunha* Cassimiro, Verdade and Rodrigues, 2008: Distribution extension with notes on natural history, color patterns, and morphometric data. *Check List* 6(2): 275-279.

Napoli, M.F., U. Caramaschi, C.A.G. Cruz and I.R. Dias. 2011. A new species of flea-toad, genus *Brachycephalus* Fitzinger (Amphibia: Anura: Brachycephalidae), from the Atlantic rainforest of southern Bahia, Brazil. *Zootaxa* 2739: 33-40.

Narvaes, P. and M.T. Rodrigues. 2009. Taxonomic revision of *Rhinella granulosa* species group (Amphibia, Anura, Bufonidae), with a description of a new species. *Arquivos de Zoologia* 40(1): 1-73.

Pimenta, B.V.S. and D.L. Silvano. 2002. Geographic distribution. *Chiasmocleis schubarti* (Schubart's Humming Frog). *Herpetological Review* 33 (3): 219.

Pimenta, B.V., M.F. Napoli and C.F.B. Haddad. 2009. A new species of casque-headed tree frog, genus *Aparasphenodon* Miranda-Ribeiro (Amphibia: Anura: Hylidae), from the Atlantic Rainforest of southern Bahia, Brazil. *Zootaxa* 2123:46-54.

Prado, C.A., M. Uetanabaro, C.F.B. Haddad. 2005. Breeding activity patterns, reproductive modes, and habitat use by anurans (Amphibia) in a seasonal environment in the Pantanal, Brazil. *Amphibia-Reptilia* 26: 211-221.

Prado, V.H.M., F.R. Silva, N.Y.N. Dias, J.S.R. Pires and D.C. Rossa-Feres. 2009. Anura, Estação Ecológica de Jataí, São Paulo state, southeastern Brazil. *Check List* 5(3):495-502.

Roberto, I.J., S.C. Ribeiro, L. Bezerra, P.B.M. Carneiro. 2011. Amphibia, Anura, Hylidae, *Trachycephalus atlas* Bokermann, 1966: Distribution extension and geographic distribution map. *Check List* 7(3):326-327.

Rodrigues, M.T. 2003. Herpetofauna da Caatinga; p. 181-236 *In* I.R. Leal, M. Tabarelli and J.M.C. Silva (ed.). *Ecologia e conservação da Caatinga*. Recife: Editora Universitária Universidade Federal de Pernambuco.

Sabbag, A.F. and J. Zina. 2011. Anurans of a riparian forest in Sao Carlos, state of Sao Paulo, Brazil. *Biota Neotropica* 11(3): 179-188.

Salthe, S.N. and W.E. Duellman. 1973. Quantitative constraints with reproductive mode in anurans; p. 229-249 *In* J.L. Vial (ed.). *Evolutionary biology of the anurans*. Columbia: University of Missouri Press.

SEMA. 2007. Secretaria do Meio Ambiente. *Mapa dos Biomas e Unidades de Conservação da Bahia*. Accessible at http://www.meioambiente.ba.gov.br/mapas/UCs%20Bahia_BIOMAS_A0_2007.pdf Captured on 11 July 2012.

Santos-Silva, C.R., C.B. De-Carvalho and S.F. Ferrari. 2012. Amphibia, Anura, Hylidae, *Dendropsophus novaisi* (Bokermann, 1968) Distribution extension and geographic distribution map. *Check List* 8(3): 499-500.

Silvano, D.L. and B.V.S. Pimenta. 2003. Diversidade de anfíbios na Mata Atlântica do Sul da Bahia; p.1-22 *In* P.I. Prado, E.C. Landau, R.T. Moura, L.P.S. Pinto, G.A.B. Fonseca and K. Alger (org.). *Corredor de Biodiversidade na Mata Atlântica do Sul da Bahia*. CD-ROM. Ilhéus: IESB/CI/CABS/UFMG/UNICAMP.

Tabarelli, M. and A. Vicente. 2004. Conhecimento sobre plantas lenhosas da Caatinga: lacunas geográficas e ecológicas; p.101-111 *In* J.M.C. Silva, M. Tabarelli, M. Fonseca and L. Lins (ed.). *Biodiversidade da Caatinga: áreas e ações prioritárias para a conservação*. Brasília: Ministério do Meio Ambiente.

Valdujo, P.H., R.S. Recoder, M.M. Vasconcellos and A.S. Portella. 2009. Amphibia, Anura, São Desidério, western Bahia uplands, northeastern Brazil. *Check List* 5(4): 903-91.

Vieira, W.L.S., C. Arzabe and G.M. Santana. 2007. Composição e distribuição espaço-temporal de anuros no cariri paraibano, nordeste do Brasil. *Oecologia Brasiliensis* 11(3): 383-396.

Vieira, W.L.S., G.M. Santana and C. Arzabe. 2009. Diversity of reproductive modes in anurans communities in the Caatinga (dryland) of northeastern Brasil. *Biodiversity and Conservation* 18: 55-66.

Vilaça, T.R.A., J.R S. Silva, M. Solé. 2011. Vocalization and territorial behaviour of *Phyllomedusa nordestina* Caramaschi, 2006 (Anura: Hylidae) from southern Bahia, Brazil. *Journal of Natural History* 45: 1823-1834.

Wells, K. D. 2007. *The Ecology and behavior of amphibians.* Chicago: The University of Chicago Press. 1148p.

Zimmerman, B.L. and D. Simberloff. 1996. An historical interpretation of habitat use by frogs in a Central Amazonian Forest. *Journal of Biogeography* 23: 27-46.

Zina, J. 2006. Communal nests in *Physalaemus pustulosus* (Amphibia: Leptodactylidae): experimental evidence for female oviposition preferences and protection against desiccation. *Amphibia-Reptilia* 27(1): 148-150.

Zina, J., J.Ennser, S.C.P. Pinheiro, C.F.B. Haddad and L.F. Toledo. 2007. Taxocenose de anuros de uma mata semidecídua do interior do Estado de São Paulo e comparações com outras taxocenoses do Estado, Brasil. *Biota Neotropica* 7(2): 49-57.

Zina, J., C.P.A. Prado, C.A. Brasileiro and C.F.B. Haddad. 2012. Anurans of the sandy coastal plains of the Lagamar Paulista, State of São Paulo, Brazil. *Biota Neotropica* 12(1): 251-260.

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